The Absolute Normalization:
Using the two-source model without a ZYAM assumption

- ZYAM Uncertainties
- Absolute Methodology
- Mach Cones & Medium Triggering

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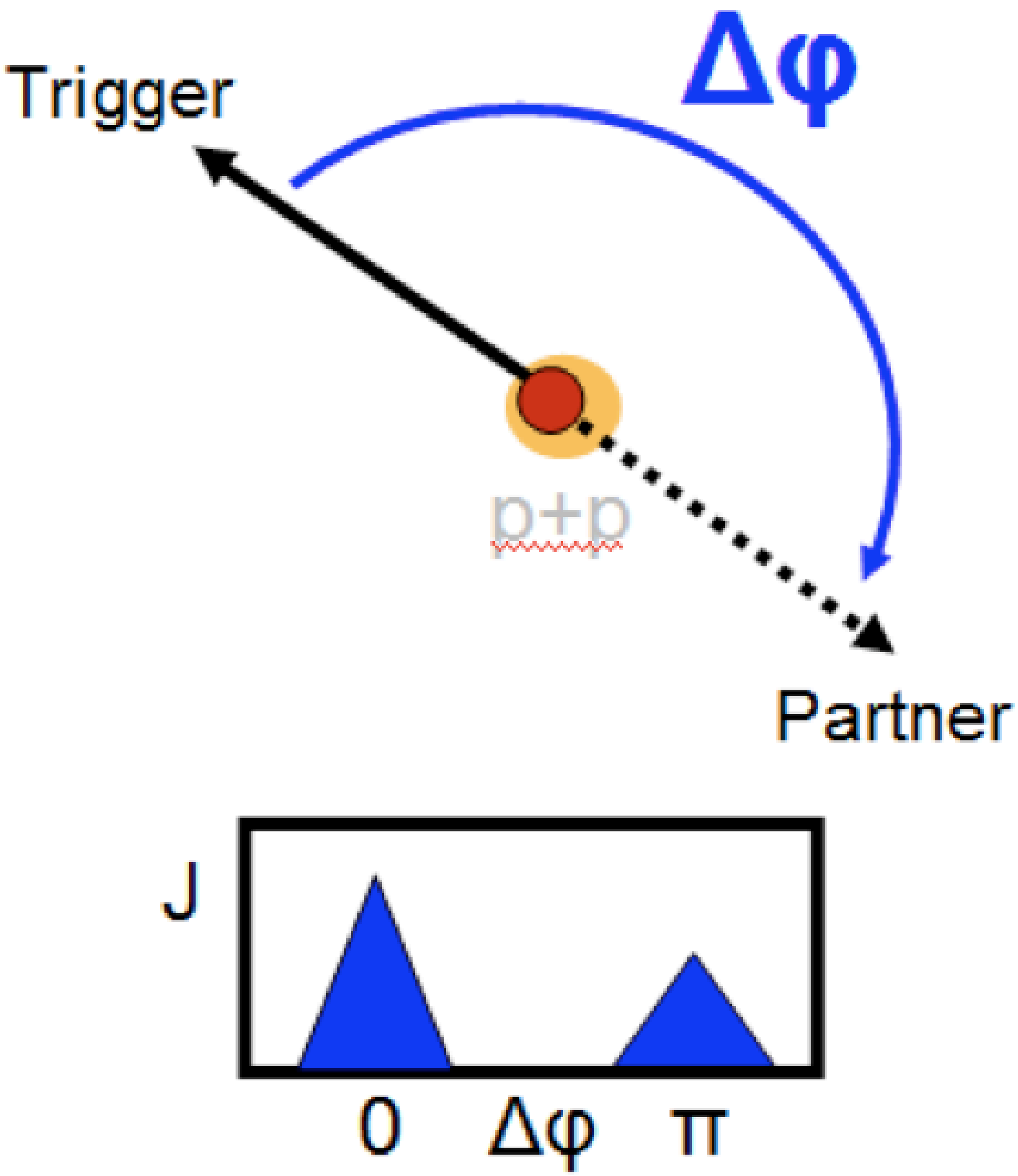
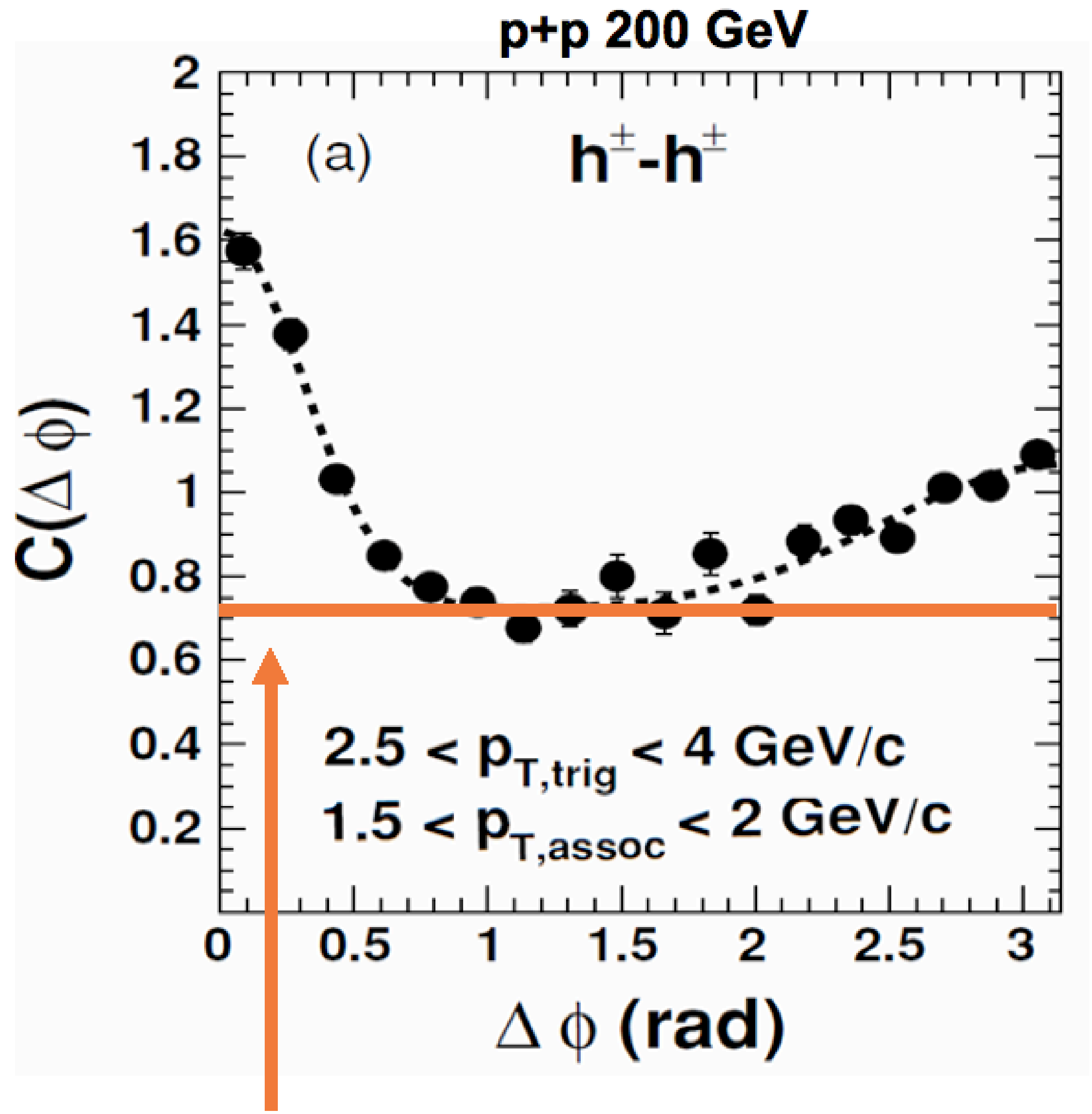
ZYAM Methods

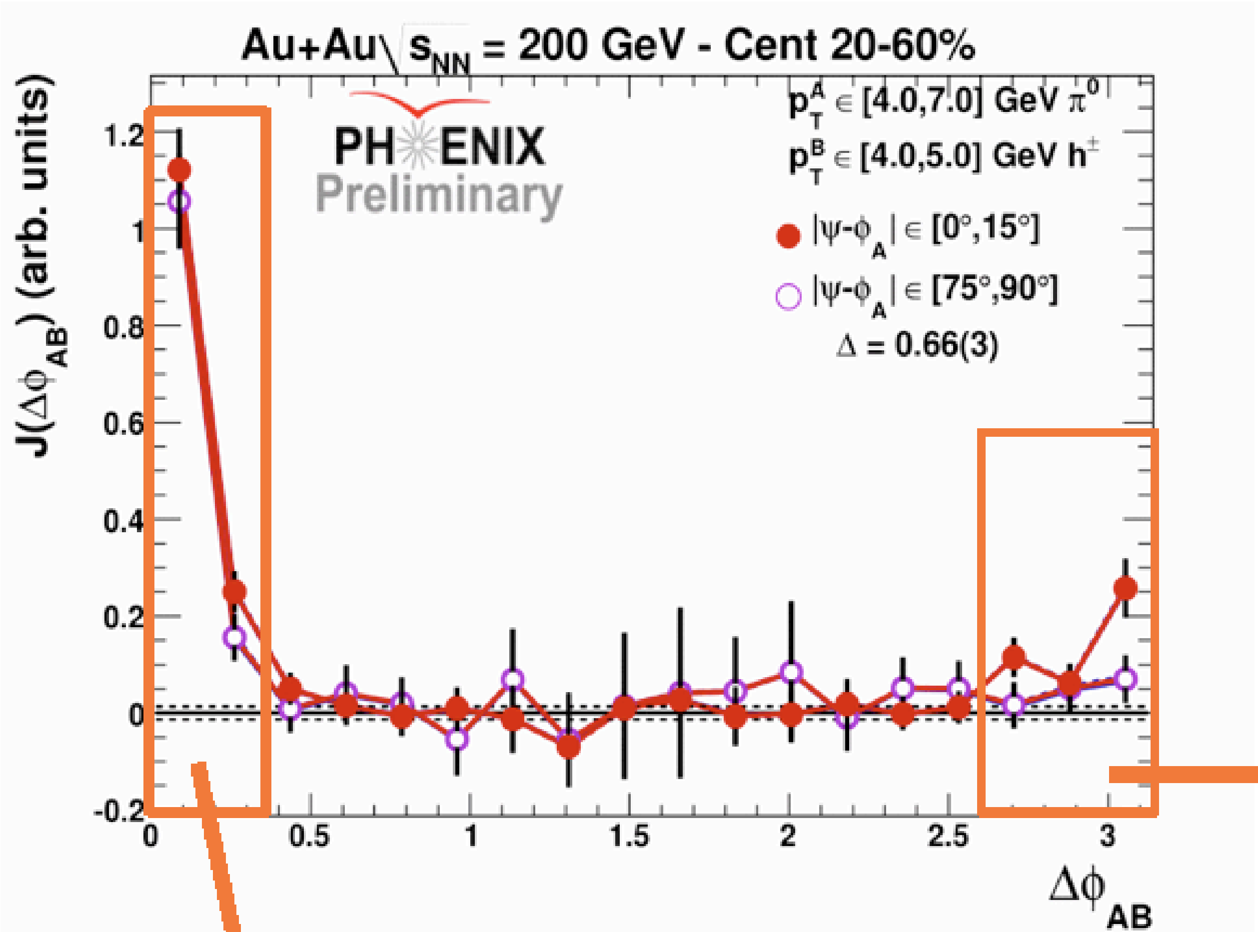


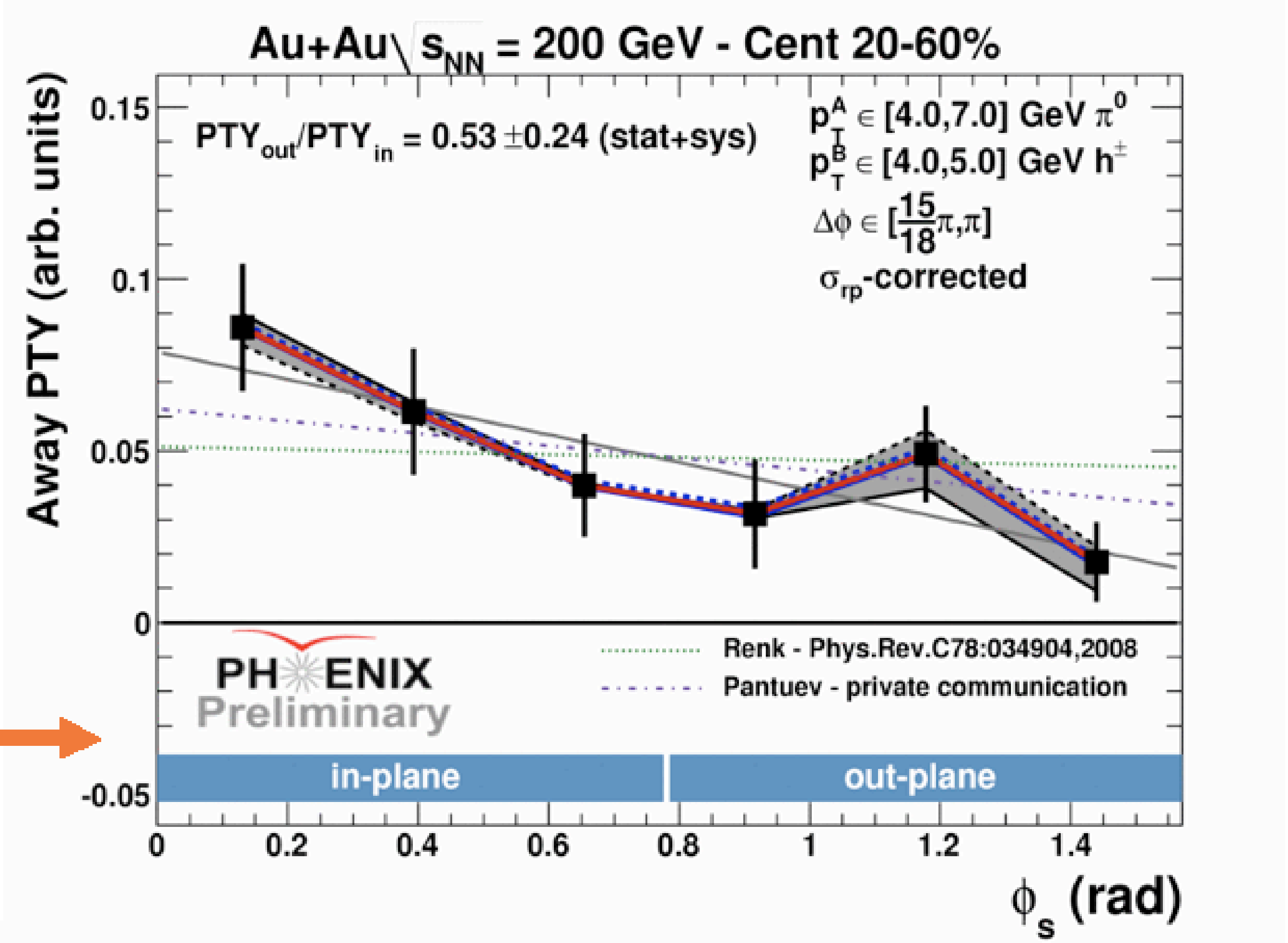


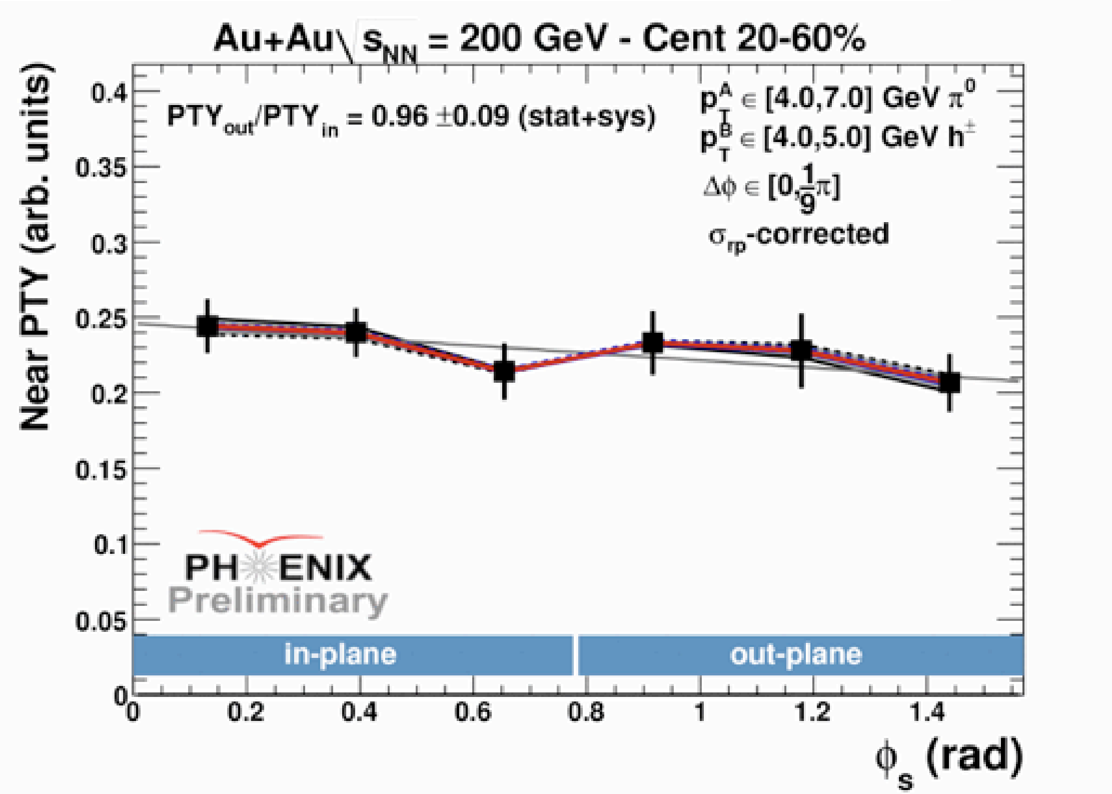
underlying event normalization via ZYAM (Zero Yield at Minimum)

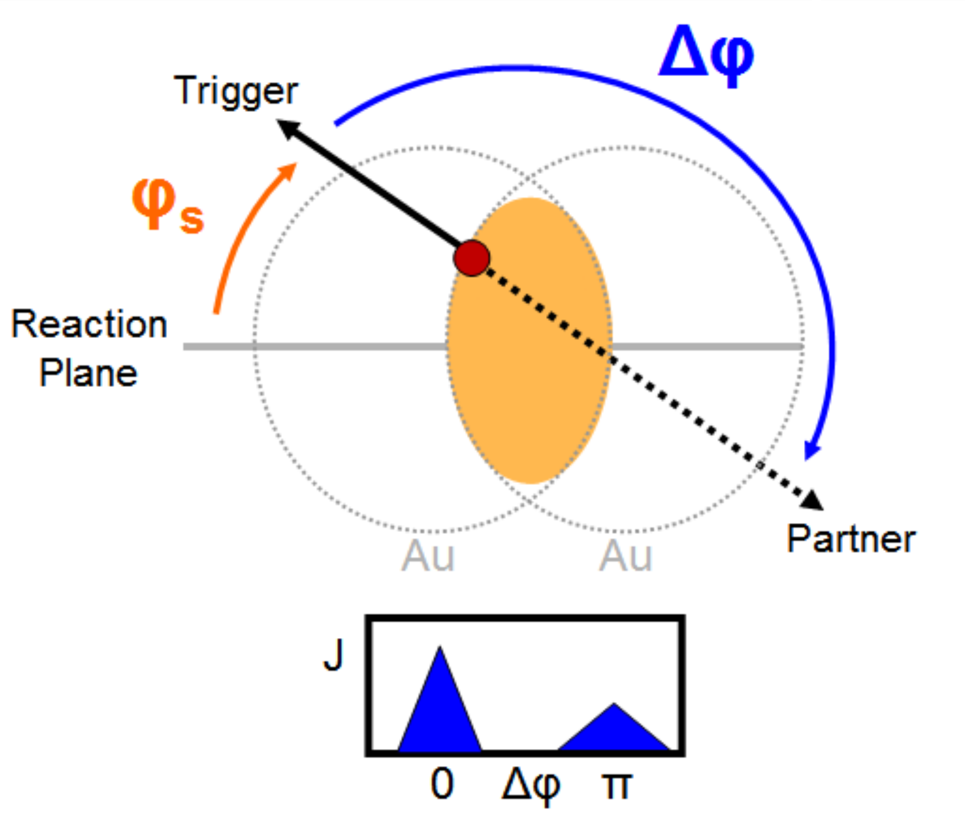
ZYAM Methods: single bin, 3 bin average, fit

Recent ZYAM result

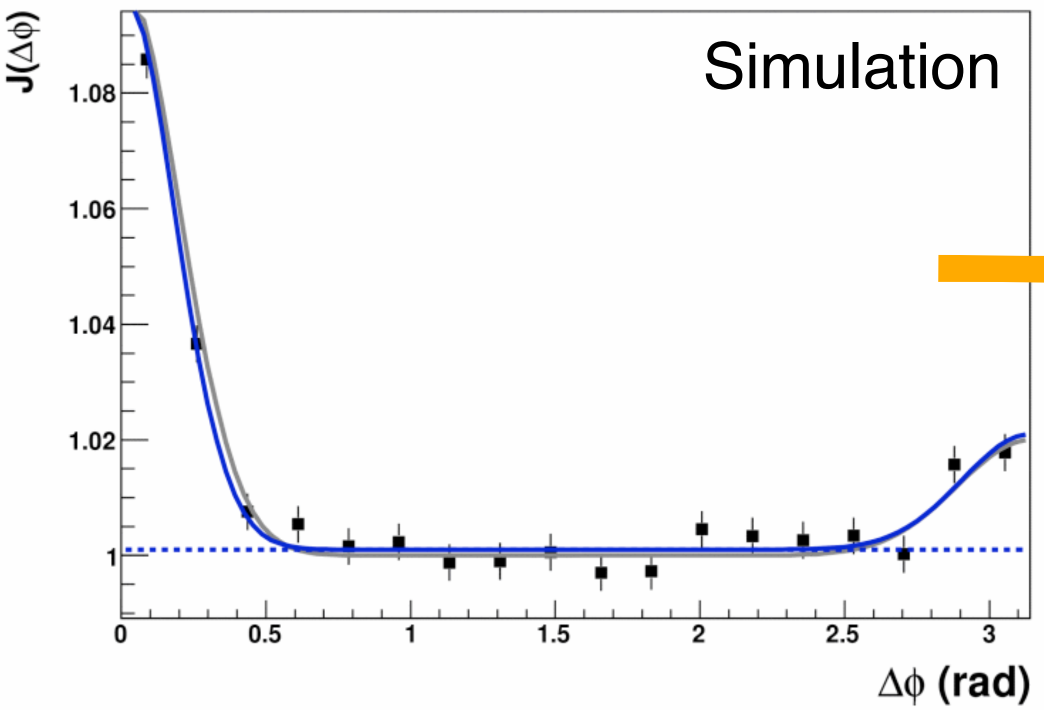


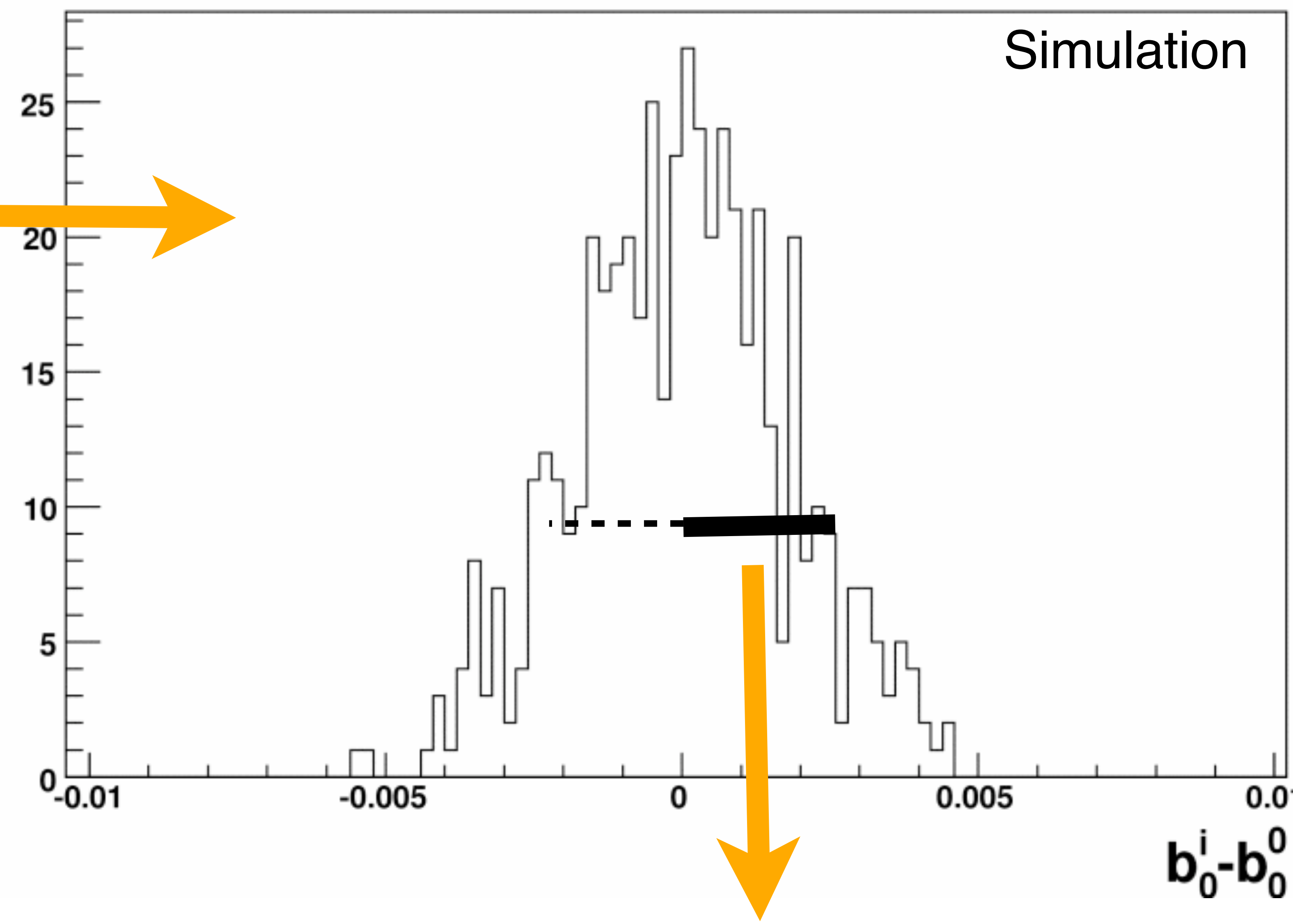






ZYAM Statistical Uncertainty





Bin Methods typically use statistical error of points (not a real estimate)

σ_{b0}

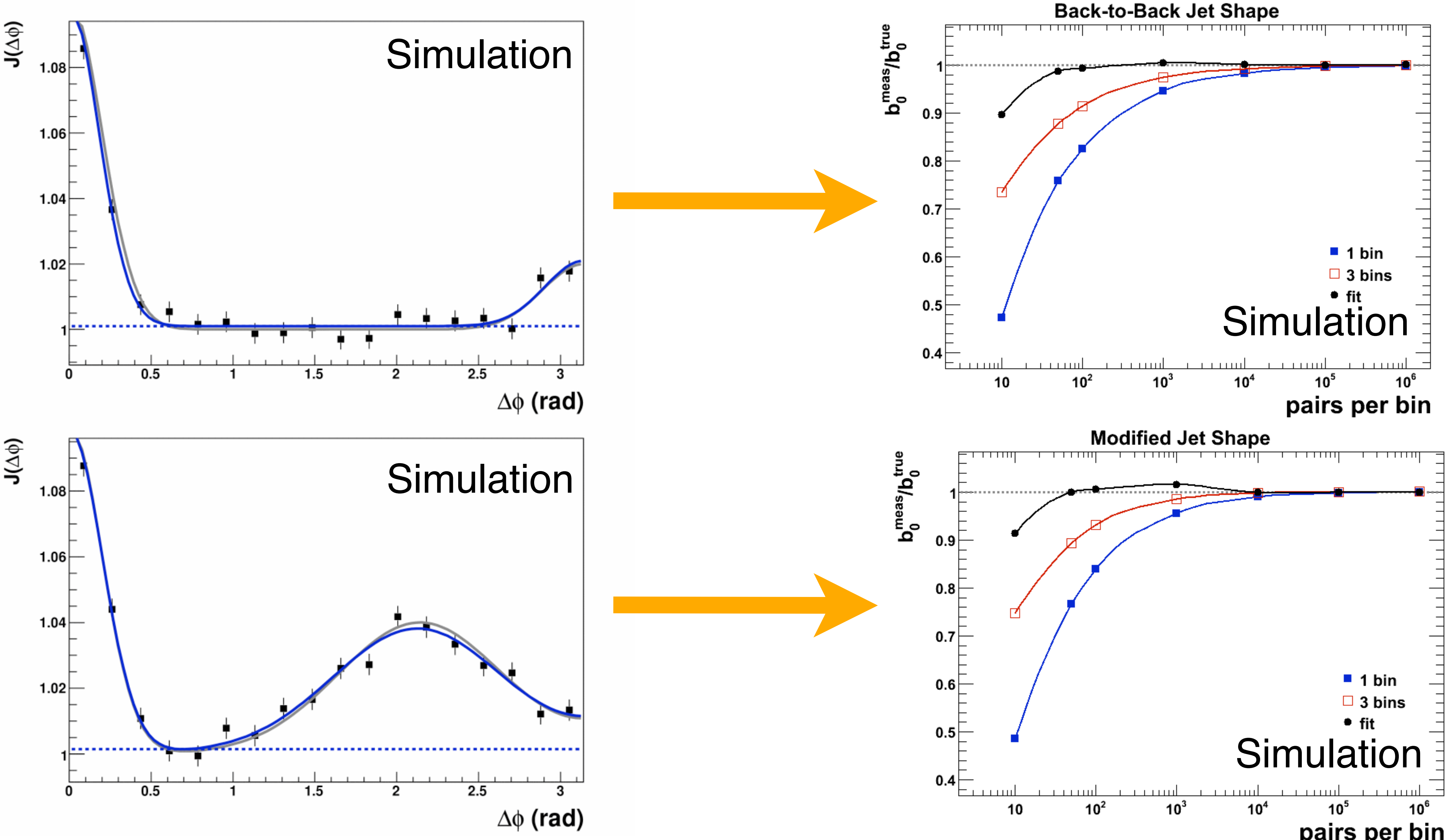
Proper Error Calculation:

- Toss new C(Δϕ) against measurement(fit)
- Fit new C(Δϕ) (fit method only)
- Extract b_0, & repeat

Don't trust ZYAM yields without this error bar!

Scatter of b_0 in tossed C(Δϕ)s is the estimation of statistical error

ZYAM Systematic Uncertainty



Binned ZYAMs deviate significantly from true value at low sampling rates
Fit method deviates most slowly (no effort to recover failed fits made here)
These jet shapes show only minor effects on

ZYAM applied at sufficiently low statistics requires an additional systematic!
(this is ~~usually not~~ never done)

Absolute (ABS) Methods

$$C\left(\Delta\phi\right) = J\left(\Delta\phi\right) - b_0\left[1 + 2c_2\cos\left(2\Delta\phi\right) + \ldots\right]$$

There are two equivalent methodologies to set b_0

Mixed Event Method:

Count average pair multiplicity in mixed events

Correct for centrality binning

$$n_{comb}^{AB} = n_{mix}^{AB}\xi \qquad b_0 = \frac{n_{mix}^{AB}\xi}{n_{real}^{AB}}$$

Mean-Seeds Mean-Partners Method:

Count singles

Count pair-cut loss in mixed event

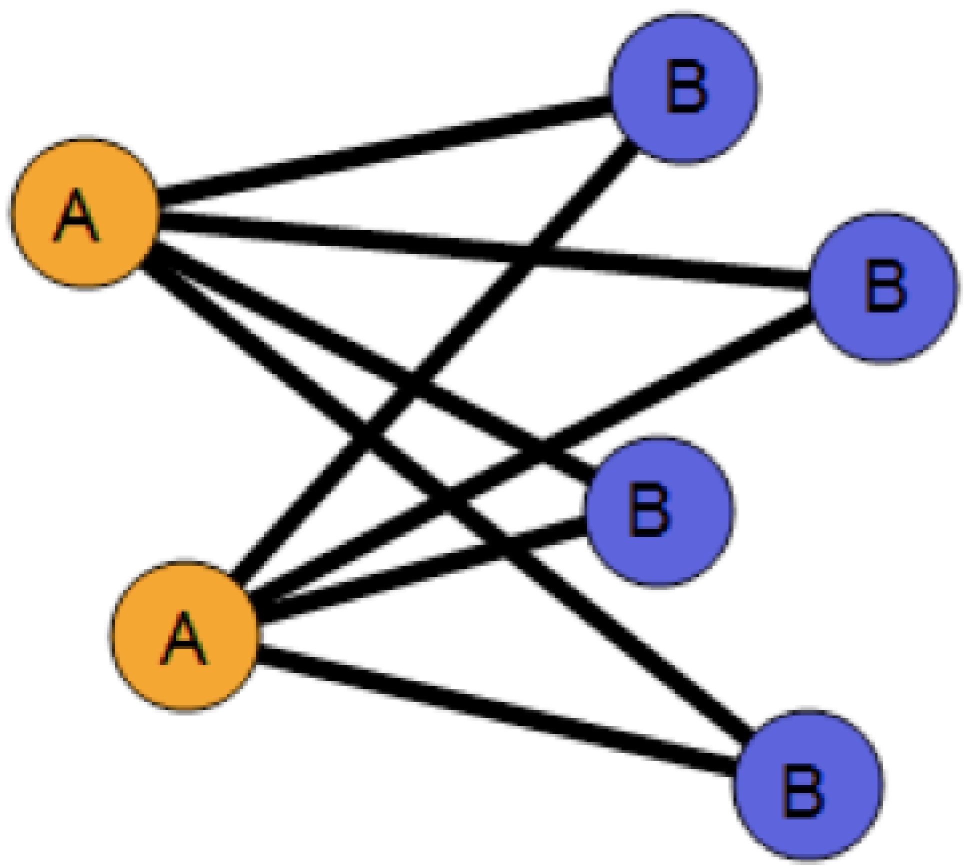
Calculate average pair multiplicity in mixed events

Correct for centrality binning

$$n_{comb}^{AB} = n^{A}n^{B}\kappa\xi \qquad b_0 = \frac{n^{A}n^{B}\kappa\xi}{n_{real}^{AB}}$$

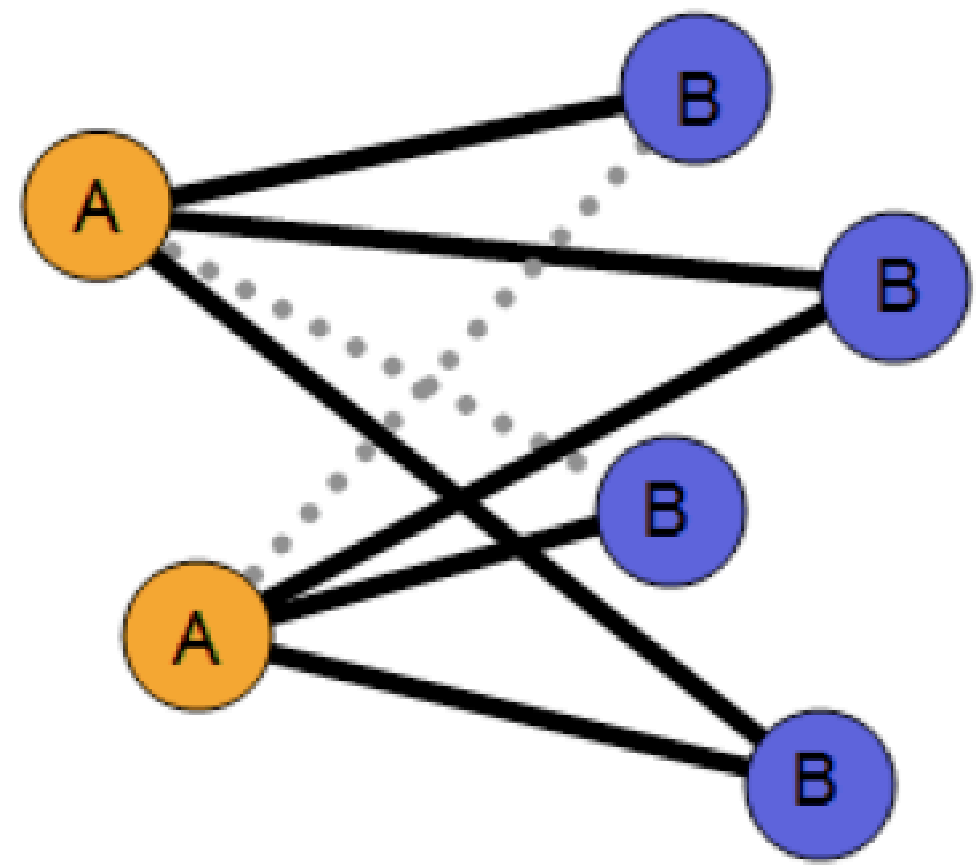
Pair-cut Correction, κ_{pc}

Calculation without pair cut correction



$$n^{AB}_{mix} \neq n^{A} n^{B}$$

Calculation with pair cut correction

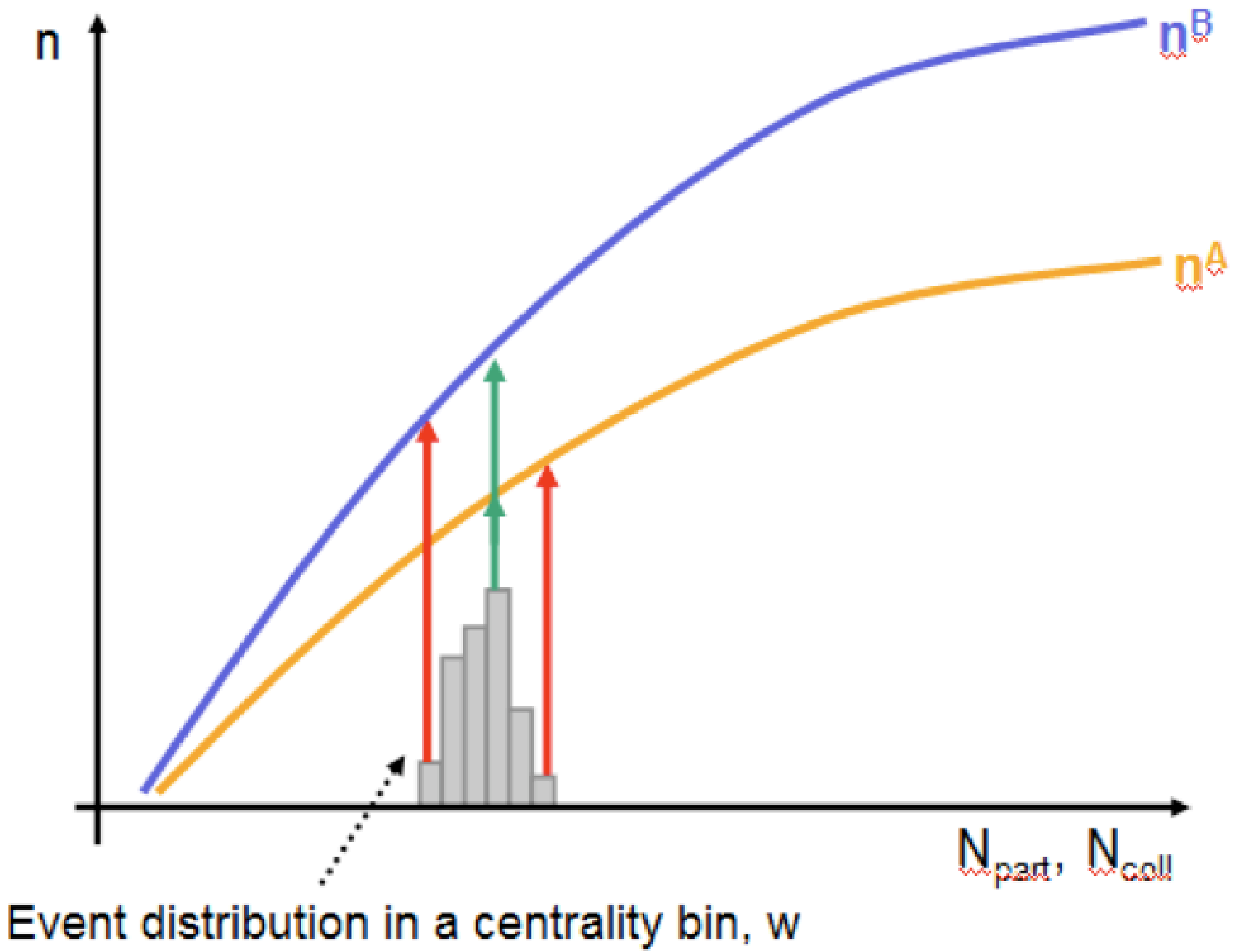


$$n^{AB}_{mix} = n^{A} n^{B} \kappa_{pc}$$

κ, the survival probability, is typically ~99.3% and can be estimated in mixed events

Centrality Multiplicity, ξ

Calculating (or mixing) for backgrounds in a centrality bin requires a correction for the multiplicity dependence across the bin



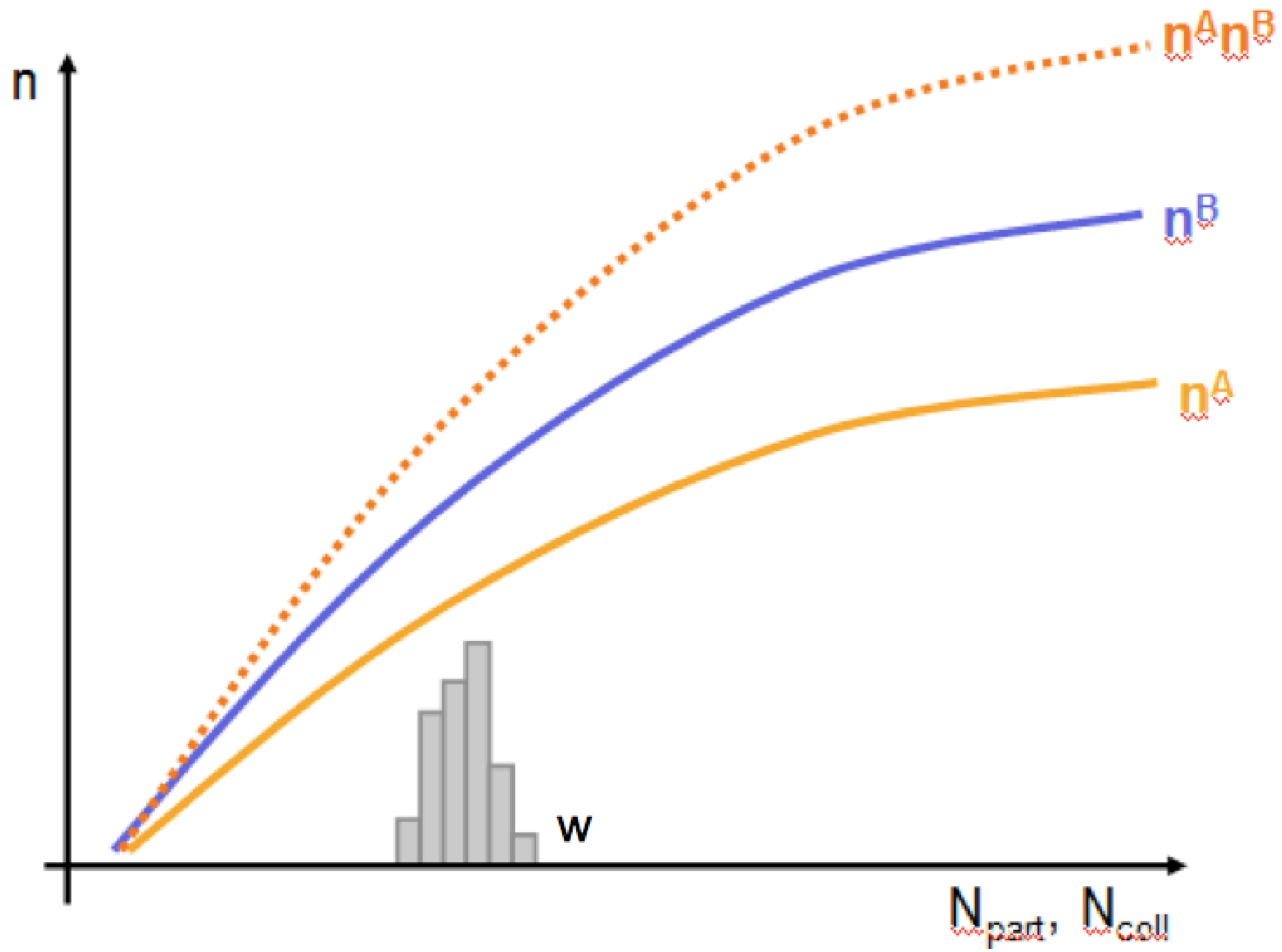
Foreground Events:

Sample particle multiplicities from the same event

Mixed Events:

Sample particles from different multiplicities

Centrality Multiplicity, ξ

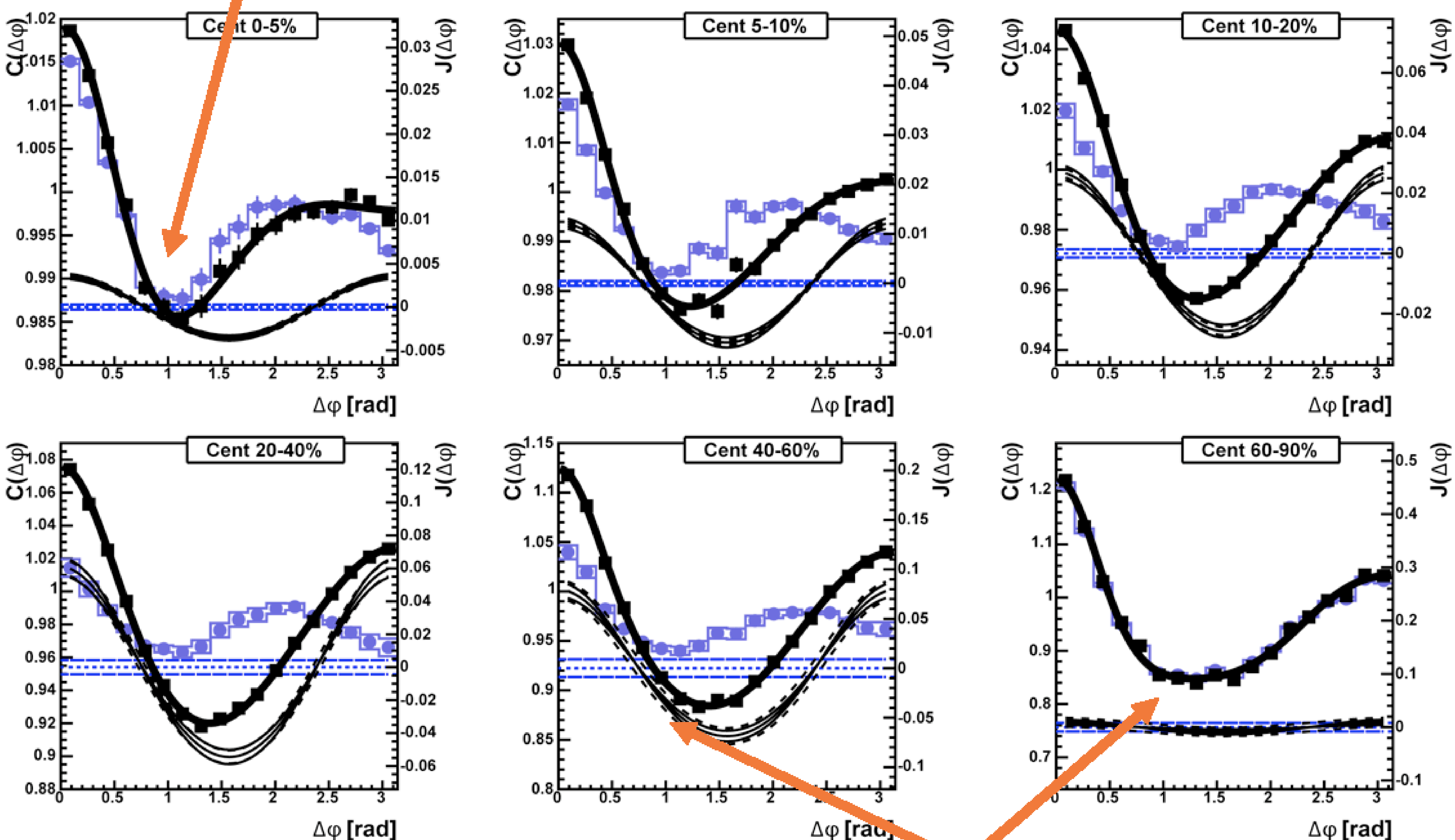


$$\xi = \frac{\langle n^A n^B \rangle}{\langle n^A \rangle \langle n^B \rangle} = \frac{\sum n^A n^B w}{\sum n^A w \sum n^B w} \sum w$$

Cent(%)	ξ
0-5	1.0011(4)
5-10	1.0025(6)
10-15	1.0044(9)
15-20	1.007(1)
20-25	1.010(3)
25-30	1.014(4)
30-35	1.019(7)
35-40	1.025(9)
40-45	1.03(1)
45-50	1.05(1)
50-55	1.06(3)
55-60	1.10(6)
60-65	1.15(9)
65-70	1.3(2)
70-75	1.4(3)
75-80	1.5(4)
80+	1.6(5)

Results

Confirmation of ZYAM procedure in most central



Black points - Inclusive
Curve - Flow
Blue points - Jet = Inclusive - Flow

Peripheral shows pedestal yield

ZYAM does not create the shoulder

Medium Response Triggers

<u>**If the Mach opening angle is near 120º:**</u>

Explains the broad Ridge $\Delta\eta$, Shoulder-Ridge similarities

Pairs from the bulk and pairs from the surface add constructively at 120º

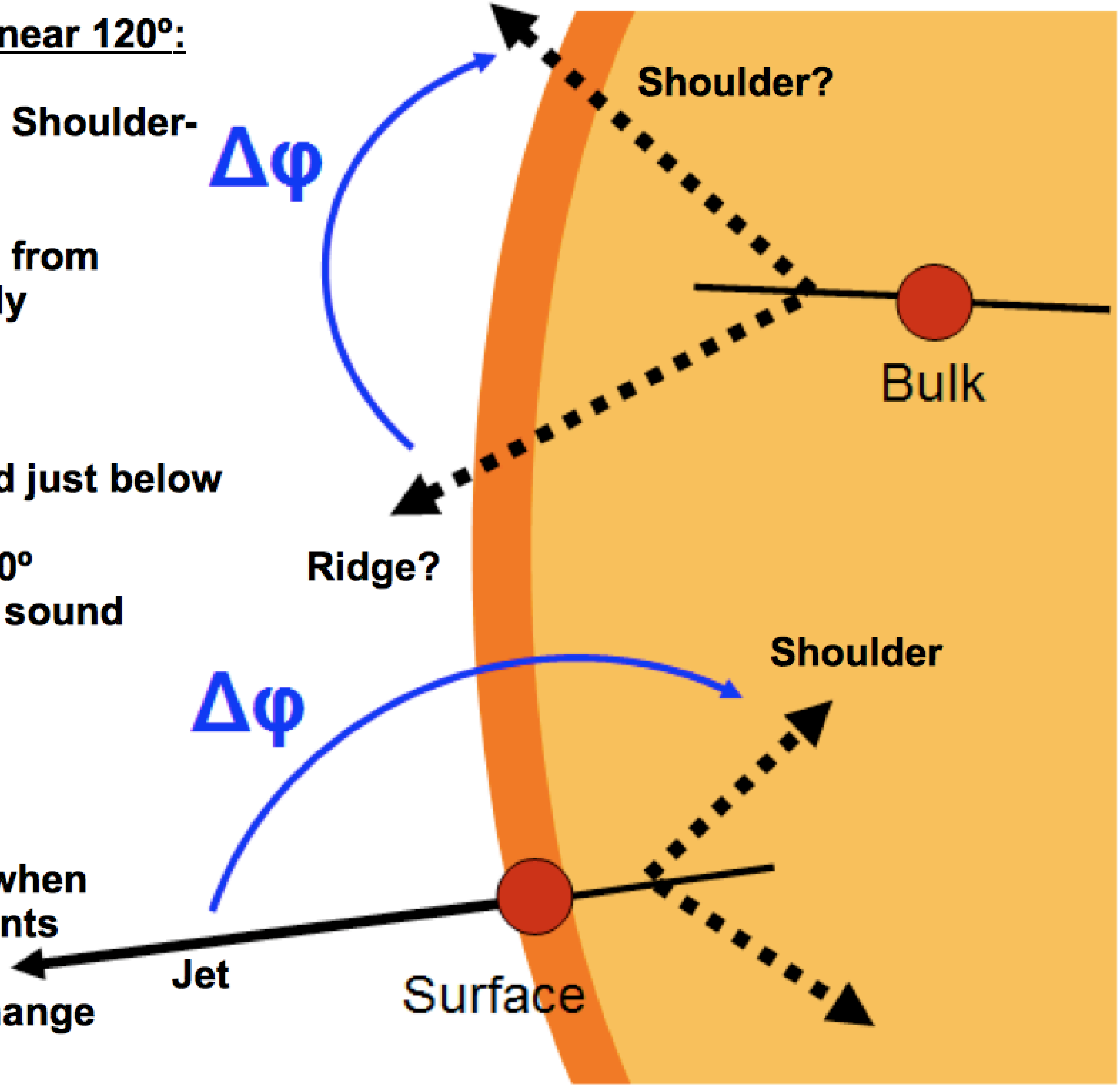
- **gives larger PTY yields**

Adding angles just above and just below 120º together will drive the measured peaks closer to 120º

- **complicates a speed of sound calculation**

<u>**Predictions:**</u>

- **Only the away-side Mach cone will appear when triggering on jet fragments**
- **Peak angle may also change**



Summary

➢ ZYAM requires the proper uncertainty estimation

➢ Absolute normalization methods confirm ZYAM is reasonable
➜ does not artificially create shoulder structure

➢ Triggering on non-jet fragments complicates the interpretation of correlation measurements at intermediate p_T
➜ per trigger yield ≠ per jet yield